Forest Research Note

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LEAFING-OUT DATE NOT INDICATIVE OF GROWTH RATE IN HYBRID POPLARS

In breeding trees for rapid growth, testing the progeny usually requires many years. To shorten the testing period, geneticists have tried to find characteristics in juvenile trees that would indicate mature-tree performance. With hybrid poplars (*Populus spp.*), work at the Northeastern Forest Experiment Station has shown that the thickness of bark on the roots of 1-year-old cuttings is significantly related to the growth rate of the tree.[1]

Among the many hybrid poplars grown on the Beltsville Experimental Forest, those that leaf out first in the spring were observed commonly to be the taller ones (fig. 1). This led us to believe that we might have here another early indicator of growth rate. We therefore made a small study to test the hypothesis that early leafing out is positively correlated with rate of growth. Although the study results did not support this hypothesis, the procedure and outcome of the study may be of some interest to other searchers for growth indicators.

Materials and Procedures

Data were taken on 120 clones, representing 38 combinations among 25 species and varieties of *Populus*. These clones all are among the better selections from the Oxford Paper Company poplar breeding program.[2] Plots of the 120 clones were distributed among 7 areas, with some dupli-

[1]Northeastern Forest Experiment Station, Annual Report 1960.
[2]Stout, A. B., and Schreiner, E. J. Results of a project in hybridizing poplars. Jour. Hered. 24: 216-229. 1933.

cations, so that 199 plots were available for observations. All plots were planted during the period 1948-50, each to a single clone; number of cuttings per plot varied from 16 to 100.

Height measurements made when the trees were 4 years old were used for the study; later height figures were considered less reliable because of the effects of diseases, insects, and thinnings. Leafing-out observations were made on all plots in 1957, 7 to 9 years after planting. The observations were made every 4 days from April 4 to May 10. A clone was recorded as having leafed out when leaves on most of the trees in a plot had emerged from the buds (fig. 2).

Regression analysis was used to determine whether height growth was a function of leafing-out date. The latter was expressed in the analyses as number of days before May 10. Regressions were run separately for each area, and for all areas together with plots pooled within areas to take out site effects. Correlation coefficients also were computed.

Figure 1. — Mid-April view of a hybrid poplar planting. The tall poplars, on the left, leafed out early. The buds on the leafless trees in the center are just starting to swell.

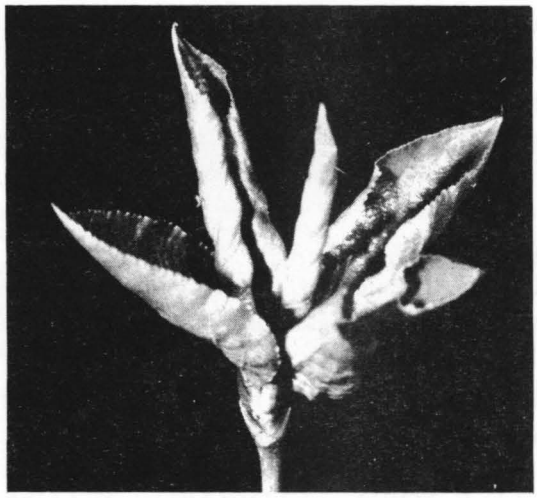

Figure 2.—This bud has just leafed out. Although the leaves are still curled, they have emerged from the bud and are individually discernible.

Results

In the analysis, height was significantly related to the time of leafing-out. The regression equation for the pooled total was:

$$Y = 9.95 + 0.2129\,X$$

where Y equaled the height after four growing seasons, and X equaled the number of days before May 10 that leafing occurred. The slope of this pooled regression, 0.2129, was very highly significant. However, the regression explained only 8 percent of the variations in height; r^2 equaled 0.082. Moreover, the regression coefficients varied considerably from area to area, ranging from +0.589 to —0.149 (table 1).

Table 1.--Regression and correlation coefficients of height growth and time of leafing-out in hybrid poplars

Population	Degrees of freedom	Regression coefficient (b)	Correlation coefficient squared (r^2)
Area A	33	0.172	0.075
Area B	8	.040	.026
Area C	31	** .434	** .203
Area D	34	* .245	* .109
Area E	19	** .589	** .448
Area F	43	-.109	.011
Area G	17	-.149	.092
Pooled within areas	191	**0.213	**0.082

* Values significantly different at the 5-percent level.
** Values significantly different from 0 at the 1-percent level of probability.

Upon more critical examination of the data, it became apparent that clones having *P. maximowiczii* as one parent accounted for much of the regression. These clones all tended to leaf out earlier, and to grow faster, than most of the others. When a pooled, within-area regression was run with all *P. maximowiczii* hybrids (30 plots) excluded, the coefficients were not significant.

Thus it was evident that what had appeared superficially to be a correlation of growth rate with leafing-out date was, in fact, only an expression of the characteristics of one particular parent species. The conclusion to be drawn from the study is that, except where *P. maximowiczii* parentage is involved, no relationship exists between leafing-out date and growth rate among the various poplar hybrids at Beltsville.

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